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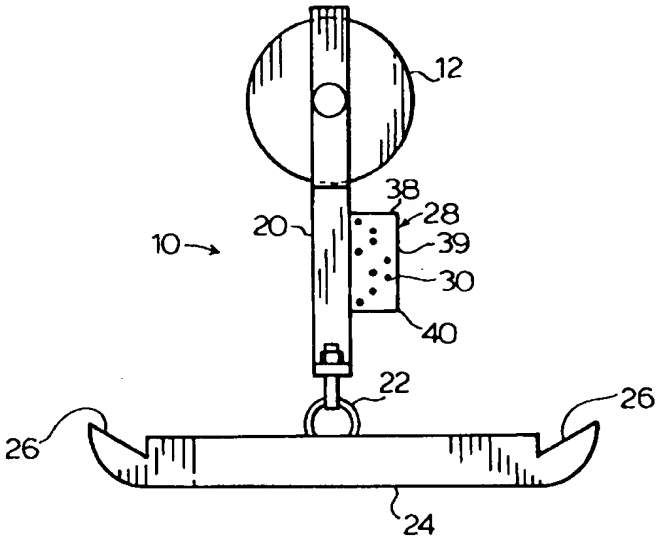

(57) Abstract

A tag identification system is provided for monitoring and tracking transport of meat in a packing plant. The tag identification system is used in conjunction with various trolley systems for transporting meat sections, such as in whole animal form, carcass form, carcass halves, or fabricated meat sections. The trolley identification tag (28) has a machine readable code on a face portion of the tag. A free edge of the tag is secured to the trolley arm (20) in a manner to position the machine readable code laterally offset of the trolley arm (20). The code is defined by a unique pattern of holes (30) where the tag (28) accommodates holes (30) of sufficient size so as not to be blocked by usual debris in a packing house. A camera system is used for reading the tags (28) which, in turn, is linked to a computer which is programmed to analyze the tag image and deduct the unique code for the tag (28). This system is particularly useful in packing plants for beef, pork and lamb.

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TROLLEY IDENTIFICATION SYSTEM

FIELD OF THE INVENTION

This invention relates to an identification tag for use on a meat trolley where each tag is unique to each trolley of the trolley system and is used to identify the particular carcass or portion thereof on the trolley during plant processing.

BACKGROUND OF THE INVENTION

In moving towards an enhanced management and identification of animal source carcasses during meat processing and fabrication, there is a need to identify and record meat quality data and other important data in respect of a particular carcass or meat section on a particular trolley. Knosby, US Patent 4,597,495, recognized this problem and provided an identification system for each trolley carrying a particular carcass. The system relied on the use of a bar code unique to each trolley which could be read at various points in the processing line. Unfortunately, bar code systems do not work very well in meat processing plants. There is considerable debris, contamination, water, mineral oils, fats and other substituents which can land on the bar code and hence render it useless for scanning purposes. Although the concept of Knosby is good, the critical aspect of his technology for reading the unique identification code failed.

Vande Berg, US patent 5,498,202, provided an alternative system for uniquely identifying a particular trolley. Vande Berg's technique is based on detecting a particular pattern of holes to identify the particular trolley carrying a particular carcass. Although the whole approach in defining a unique hole pattern is advantageous over Knosby, US patent 4,597,495, in actual plant use the Vande Berg system malfunctions, because the pattern of holes were limited by machining the holes in the trolley strap. This limited the number of holes and the size of holes so that the strength of the trolley strap was not

compromised. Furthermore in order to detect any canting or sloping of the trolley strap, Vande Berg required the use of two alignment holes, one positioned above the other in the trolley strap to detect angulation of the strap in attempting to read the pattern of holes in uniquely identifying that particular trolley and thereby the carcass carried thereon. Machining of holes in the individual trolley straps is time-consuming and does not lend itself to computerized machining. Forming of the holes in the strap normally at the plant is cumbersome and does not lend itself to retrofit. Furthermore, it is difficult to test the machine trolley straps to ensure accurate hole patterns before reuse. The other significant problem with the Vande Berg system is that the holes defining alignment as well as the holes for the unique pattern are small in size and hence may readily plug with debris, thereby throwing off not only the reading of the pattern, but as well detecting the orientation of the trolley strap during the reading process.

In accordance with an aspect of the applicant's invention, a trolley identification system is provided which overcomes most, if not all, of the above problems with the prior Knosby and Vande Berg systems and readily allows the trolley identification system to be retrofitted on an existing packing house trolley line and a variety of trolley designs.

SUMMARY OF THE INVENTION

In accordance with an aspect of the invention, a meat trolley has an identification tag attached thereto without compromising meat trolley strength. The identification tag has a machine readable code peculiar to the particular meat trolley. The tag has a free edge portion and means for attaching the free edge portion to the trolley at a predetermined location to facilitate machine reading of the peculiar code. The tag has a plurality of holes formed therein which extend through the tag and are formed in the tag in a pattern unique to the peculiar code for the meat trolley.

In accordance with another aspect of the invention, a tag identification system for monitoring and tracking transport of meat in a packing plant is provided. The tag identification system is used in conjunction with a trolley system for transporting sections of meat in whole animal form, carcass form, carcass halves or fabricated meat sections. The trolley system comprises individual trolleys for transporting individual sections of meat by hanging individual sections of meat from a trolley arm. A trolley identification tag has a machine readable code on a face portion thereof and a free edge which is secured to the trolley arm in a manner to position said machine readable code laterally offset of the trolley arm. The machine readable code comprises a plurality of holes formed in and passing through the tag. The holes are arranged in a pattern of three vertical rows where the pattern of holes in the three vertical rows are unique to the particular trolley. A camera system for reading the tags comprises a light source for illuminating the tags and a camera for reading the tags. A computer is linked to the camera and is programmed to analyze an individual tag image recorded by the camera. The tag accommodates at least five holes in each vertical row where the pattern of holes defines the machine readable code in preferably base three arithmetic. The programmed computer aligns the image of the tag and assigns each hole of the image of hole pattern a value to determine thereby the unique code for the tag. Means for sensing presence of the trolley tag to activate the camera to image the tag hole pattern. The light source is of sufficient intensity to illuminate holes at least partially blocked with oil, water, ice, translucent debris and the like.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention are shown in the drawings wherein:

Figure 1 is a plan view of a standard carcass trolley;

Figure 2 is a side elevation of the trolley of Figure 1;

Figure 3 is a plan view of the trolley tag showing a complete pattern of holes;

Figure 4 is a plan view of an alternative embodiment for the trolley ID tag on the meat trolley;

Figure 5 is a plan view of an alternative embodiment for the trolley ID tag on the trolley;

Figure 6 is a plan view of yet another alternative embodiment for the tag;

Figure 7 is a side elevation view of the trolley of Figure 6;

Figure 8 is a top view of the trolley of Figure 6;

Figure 9 is a block diagram of the system for detecting the pattern of holes on the tag;

Figure 10 is an enlarged view of the tag sloping in the x-y plane;

Figure 11 is a section through the tag of Figure 10 showing accumulation of debris in the holes;

Figure 12 shows a computer image of a trolley tag in its sloped orientation;

Figure 13 shows a computer image of the trolley tag of Figure 12 reoriented so as to vertically align the holes in each row for purposes of reading the unique code of the tag;

Figure 14 is a schematic of a meat processing line for beef showing the various trolley systems involved in the processing line;

Figure 15 is a schematic of a meat processing line for pork showing the various trolley systems;

Figures 16, 17, 18 and 19 are side views of various types of meat trolleys; namely shackle trolley, carcass trolley, whole carcass trolley and fabrication trolley.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In accordance with this invention, a reliable meat tracking system is provided for a processing plant. The tracking system readily accommodates the transfer of meat sections from one trolley to the next in a processing line while continuing to track the individual particular section of meat and trace it back to the animal arriving at the processing plant. Such trace-back to the source of the animal provides many benefits in taking steps to enhance the efficiency of the meat industry. The tag identification system is readily adapted for use in a variety of animal carrying trolleys, such as leg hooks, shank hooks, gamble hooks, carcass hooks, meat section hooks, fabrication hooks and the like. These various types of trolleys may be made of a variety of materials and the tag system of this invention readily accommodates that variation of materials. Some examples of the various hook designs will be described with respect to the Figures 16 through 19. The trolley identification system also readily permits the collection and storing of data in respect of the animal characteristics as determined during meat processing. Information to be tracked includes the weight of the animal at kill, carcass weight during processing, blood sample information, organ inspection information, trimming information, pathology information, contamination information, meat quality in terms of grading, meat quality by way of visual automated assessment, and meat quality determined by meat tenderness probes, such as described in co-pending US patent application SN 08/775,497 filed December 31, 1996 entitled "Software Controlled Meat Probe for Use in Determining Meat Tenderness " and Canadian patent application 2189817 filed November 7, 1996 entitled "Apparatus for Use in Determining Meat Tenderness". The tag system, according to this invention, provides reliable, accurate reading of the tags by use of an integrated software system. The tags permit significant flexibility in the standardization of the hardware and software and in the identification of animal and/or carcasses from the time the animal approaches the processing plant to the time its carcass has

been split up into individual cuts on trays. From the time of animal slaughter until or beyond meat fabrication, it is necessary to identify certain characteristics of each carcass so that its overall quality, weights and other related data are stored and associated with respect to the carcass on that particular trolley. Such information is compiled for purposes of directing the carcass for particular cuts; directing certain cuts to particular purchasers and identifying the supplier of the animal for purposes of payment depending on the meat grade. The ID tag for each carcass trolley has a unique pattern of holes to identify the trolley and hence the whole animal, carcass or meat section hanging thereon as it proceeds through and is transferred from trolley to trolley in the meat packing operation from the time of slaughter until meat fabrication. A system is provided for imaging the ID tag to detect the unique pattern of holes in the tag, so that as the trolley proceeds past each check point, the tag can be read and relevant data developed at the check point is entered in a central processing system to be associated with that particular carcass. Normally, the reading of the ID tag is automatic where the operator enters data collected in conjunction with that carcass at each reading station. Obviously, weighing of the carcass and perhaps even testing carcass quality may also be automated and data correspondingly entered with respect to that particular carcass as identified by the ID tag.

The significant advantage of this invention is that the ID tag is separate from the trolley arm and can be manufactured off site and retrofitted on existing trolleys. One may weld the ID tag to the trolley arm where its exact placement on the arm is not critical because the system for reading the ID tag is capable of reading the tag by virtue of locating on the corners or side of the tag. The ID system is attached to the trolley in a manner that the two corners or side of the tag can be detected or extrapolated and then the tag spatial attitude on either the vertical or horizontal plane assessed to thereby determine the orientation of the pattern of holes in the tag. This feature is a significant advance over prior art

systems in that the corners of the tag can either be individually read or at least the plane of the side edges of the tag can be detected, so that the corner or side orientation can be extrapolated to thereby give a tag orientation during the identification of the hole pattern.

The tag system according to this invention is of a larger size so that it readily accommodates debris, water, mineral oil and the like which can collect on the tag, not only on the corners and sides but as well in the holes. Hence the system of this invention is less susceptible to mislocation or misinterpretation of the data due to foreign material interference. The tag system is applied to the trolley in a manner which does not weaken the trolley strength and in some situations, may even increase the strength of the trolley. The tag, when manufactured at the plant, can be readily tested to ensure accuracy of the hole pattern as well as the desired uniqueness of the entire pattern. The tag may be set up in jigs to provide for automated drilling of the holes, automated checking to ensure that in any one shipment to a particular plant there is no duplication in the unique identification for each tag. Because the tag may be of any size, there is no limitation on the number of holes, the rows of holes and the size of the holes. This is quite important and distinctive from Vande Berg which required placing all of the holes in the arm of the trolley where the holes had to be small so that the trolley arm was not weakened.

Other advantages and features of the trolley identification system include, for example by virtue of the tag construction, easy rework of a faulty or damaged tag is readily achieved and because of the size and robust nature of the tags, the hole size in the tags can be of correct dimensions so as to permit easy reading of the tags. The hole size is not limited by virtue of the shank portion of the various hook designs as will be described in the following Figures. In that respect the tag may be used to, in actual fact, strengthen the carrier system by avoiding the need to drill holes in the shank of the carcass carrier. The tags readily accommodate roller wear and do not interfere with the

application of tare weights on the carcass trolley. The tags readily accommodate variation in speed of movement of the carcass trolleys where reading rates close to 100% can be realized. The tags avoid having to mix and match various systems for tracking the animal and carcass from the knock box to the trays. The tags are readily adapted to various trolley constructions and configurations and materials, such as switching from metal to plastic trolleys. By virtue of the tag design, future designs for the industry are readily accommodated because the tag system is not based on any particular trolley design. The tags readily function in a frozen environment where the holes may become filled with ice, but are still acceptable in providing accurate "reads" due to the hole sizing in the tag. The tags can be readily used on trays which carry cut-up sections of the carcass to now provide tracing of the fabricated sections back all the way through to the animal and as well back to at least the farmer who last cared for the animal.

Various preferred embodiments for the identification tag of the trolley system are shown in Figures 1 through 8. The trolley 10 of Figures 1 and 2 has a trolley wheel 12 which rides on a suitable track. The wheel is encased in a U-shaped arm 14 which has a pin 16 passing therethrough to support the wheel 12. The wheel 12 is provided with an annular groove 18 which rides along a suitable track. The arm 20 of the trolley extends downwardly from the U-shaped member 14 to support a clevis 22 on which the carcass hanging arm 24, having suitable outwardly spaced-apart hooks 26, is provided. It is appreciated that a standard single beef hook may be provided on the clevis 22 or a single hook for a side of beef or pork, as will be described with respect to Figures 16 through 19. The trolley identification tag 28 is secured in any of a variety of manners to the arm 20. The tag 28 may be made of plate steel and can thereby be fastened to the arm 20 by welding, bolts, rivets and the like. Alternatively, the tag 28 could be made of plastic, other metals and metal alloys and various fiber reinforced synthetic composites and, accordingly fastened with adhesives,

fasteners, welding and the like. The tag 28 may also be fastened to the arm 20 by a clip type catch into which the unique tag is inserted and securely held in place. This permits ready changing of damaged tags or the use of different tags to identify separately and distinctly hog carcasses, cattle carcasses, poultry carcasses and the like. The identification tag 28 has a unique pattern of holes 30 formed therein where the holes, as shown in Figure 3, may be selected in terms of spatial positioning from any one of the three rows 32, 34 and 36. With the particular matrix of Figure 3, it would be possible to provide for three rows of holes where, in each row, there is the potential of nine holes. The vast number of unique permutations and combinations, upwards of 20,000, will most likely provide a unique code for every one of the trolleys in the packing plant. If, however, the permutations and combinations of these holes are not sufficient or in some environment where the number of holes are limited, it is possible to make the tag either longer and/or wider to accommodate more rows of holes or larger holes for that specific use. The other important feature of the tag is to provide to the side of the arm 20, two visible corners, such as corners 38 and 40, or the side edge 39. These corners or side edge are important from the standpoint of detecting the orientation of the tag in assessing the unique pattern of holes. This procedure will be discussed in more detail with respect to Figures 9, 10, 12 and 13.

An alternative arrangement for the ID tag 28 is shown in Figure 4 where the tag is welded to the face of the arm 20 and some of the holes 42 are drilled through the arm 20. This procedure may be used where weakening of the arm is not critical and usually where lighter carcasses are carried, such as carcasses of poultry, lamb and the like. Again, the tag 28 is positioned on the arm 20 such that the upper and lower corners 38 and 40 are visible. In Figure 5, the ID tag 28 may be fastened to the face of the arm 20 where the unique pattern of holes 44 are provided. In this embodiment, the tag 28 has four detectable corners 46, 48, 50 and 52. As well, this size of tag provides for a greater

number of holes or columns of holes to accommodate uniqueness of the tag for identifying the particular trolley. Also with four corners visible, the orientation of the tag is more readily detected.

Figure 6 shows yet a further alternative mounting of the ID tag 28 on the top of the U-shaped wheel carrier 14, where its positioning is shown in more detail in Figure 7. The tag 28, as mounted on the U-shaped carrier 14, may be used independently or in combination with an ID tag on the arm 20. There may be situations where the orientation of the carcass trolley is required in not only the x and y plane, but as well the z plane. By having a tag on top of the trolley as well as on the arm allows one to detect the orientation of the tag in the x, y and z directions. In any event, the ID tag 28 may be used singularly on top of the U-shaped arm 14 where, as shown in Figure 8, the holes 54 in the tag 28 are visible from above. Such variety in the positioning of the tag demonstrates the flexibility of the system The reader system may be positioned above the trolley to detect the unique hole pattern where, in this particular embodiment, all four corners 56, 58, 60 and 62 are visible for detecting orientation of the ID tag during the assessment of the unique pattern of holes. This system is particularly adapted when the carcass is carried on the hooks 26 and tends to rotate primarily through the z axis, rather than tilt through the x and y axis.

The system for detecting the pattern of holes is schematically shown in Figure 9. The trolley arm 20 has the tag 28 mounted thereon. Behind the trolley arm 20 is a back light 64 which projects light in the direction of arrows 66 through the tag 28 towards a light detector 70 mounted on a camera 72. The back light and camera are in communication with a central processor or computer which determines the operation of these devices in detecting the pattern of holes in the tag 28. The details of these devices and the software used in detecting the pattern of holes is quite varied. For example, the system described in US patent 3,858,032 may be used in detecting a unique pattern of holes, where, in accordance with this invention, the light detector 70 is also

used in conjunction with the camera 72 and a central processor 74 to detect the orientation of the corners of the tag. There are available several devices and software which can be used to image the tag periphery and hence detect the corner locations or side edge or other edge and then map them on an x and y axis to determine the orientation of the corners and hence the tag in the x and y direction. Such procedure is described in more detail with respect to Figures 12 and 13. As a general guide, an individual tag is prepared for each item in the meat processing facility to be identified. These tags contain a unique hole patter as described. The pattern consists of drilled holes arranged on the tag to represent a specific number when imaged with the image processing electronics and analyzed through the decoding software. The image is acquired in one of two ways. One method, as shown in Figure 9, is to align the video camera, coded tag and illumination source so that as the item to be identified passes by the camera, the tag is located between the camera and illumination source to give a silhouette or backlight image of the tag. The second method is to arrange the video camera, coded tag and illumination source so that at the time the tag to be identified passes by the camera, the illumination source is located between the camera and illumination source to give a front light image of the tag. As the tag to be identified passes the camera, a sensor is triggered to initiate image capture.

Once the image is captured, the coded tag is viewed showing the hole pattern. The image is then analyzed using the decoding software in the central processing unit 74. The decoding software looks at each hole in its relationship to the others. Each possible hole position is given a value. Once the holes are located and their relative position determined, the number represented by the coded tag is calculated. Sequencing of the camera, input and output is achieved through the system control software.

The system is capable of transferring collected data on a particular carcass as identified by a unique trolley tag to another trolley tag should the

carcass be transferred to a different trolley having a different ID tag. For example, a pork carcass on a hook of Figure 1 may be sawn in half and each carcass half placed on a single hook having a different ID tag. All the data on the whole carcass is transferred to the half carcass tag. Such procedure is described in more detail with respect to Figures 14 and 15.

As shown in Figure 10, the tag arm 20 with the tag 28 secured thereto is tilted or sloped through the x and y axes 76 and 78. By imaging the position of the corners 38 and 40, one is able to determine the slope of side edge 80 and hence determine the slope or angle of the columns 32, 34, and 36. In assessing the angle of the tag, one can then, with suitable software, rotate the geometry of the tag to the vertical and horizontal planes so that the pattern of the holes can then be assessed to identify the unique code of the tag for that particular trolley. Alternatively, the system for detecting the pattern of holes can be angled to the detected angled corners to then, in turn, pick up on the columns and the location of holes in those columns to provide a unique identifier for the particular trolley. Further details of the system are described with respect to Figures 12 and 13.

Because the tag 28 has larger holes 30, water, oils and the like normally do not collect in the holes. The holes preferably range in size from 1/8 inch to 3/16 inch. Although even if fat 82 or other debris were to collect in the holes and partially block them off, light can still be transmitted through the balance 84 of the hole to provide the necessary indication of the simple existence of the hole and not necessarily its exact position. This is an important advantage over Vande Berg which requires that the locating holes be clear of debris, because it is essential that the orientation of those holes be precisely located in order to pick up on the pattern of holes in the tag. With applicant's system by locating on the corners 38 and 40 or side edge, debris may be present in the holes where less than 100% of the light is transmitted, but still sufficient light is present to indicate the location of a hole. It is also possible that, if translucent material 86

is in the hole 30 which might be translucent fat, oil, water, ice and the like, providing there is some transmission of light to indicate the existence of a hole, the pattern of holes can then be assessed. In addition, debris building up on the corners 38 and 40 of the tag are not necessarily a problem, as long as the imaging system can pick up on the orientation not only of the edge 80 and perhaps as well the top edge 88 and the bottom edge 90, the extrapolated positioning of the corners 38 and 40 can be determined so as to assess the orientation in the x and y axis.

As shown in Figure 11, the light source 64 projects light 68 at the tag 28 where debris 84 gathers in the hole 30, but still allows some light 92 to pass through the hole so that the imaging system can pick up on the light. Correspondingly, light 68 may pass through the translucent material 86 to allow some light 94 to pass through the hole and again be detected by the imaging system to indicate the existence of a hole on that particular column of the tag.

As shown in Figure 12, the tag 28 is shown in a sloped attitude in the x and y axis, somewhat like the sloping of the tag in Figure 10. With the tag in this attitude, it is very difficult to determine the unique pattern of the holes 30. As described with respect to Figure 10, the image of Figure 12 may be analyzed by computer software to locate the tag corners 38 and 40 and as well locate the tag edge 80. In the alternative locating a tag edge 80 is sufficient providing the software has the capability to then orient the tag to the vertical orientation as shown in Figure 13. With the tag 28 in the vertical orientation for the x and y axis, the three rows of holes 32, 34 and 36 are vertically aligned as indicated by the vertical orientation of edge 80 and the vertical columns defined by boxes 100, 102 and 104 in the video image. Boxes 100, 102 and 104 define the boundaries for determining in which row 32, 34 and 36 the holes 30 are located. By video imaging, each hole 30 has its apparent center marked with an "X", such as at 106. Providing the apparent center of each hole is within the respective box 100, 102 and 104, the hole is taken to be in that location for

purposes of determining the unique code for the hole pattern. In accordance with a preferred embodiment of this invention, each row 32, 34 and 36 has at least one hole and most preferably proceeding from top to bottom along the tag, there is a hole at each level in one of the three rows. For example in this embodiment, there is a hole at each level for the nine levels from the top to bottom of the tag. Accordingly, the software detects in column 32 three holes which are at levels 2, 7 and 9 as shown along the edge 80. In column 34, there are holes at levels 3, 5 and 6 and in column 36, there are holes at levels 1, 4 and 8. Optionally, a hole may be provided beneath column 102 in row 34 to indicate the center row 34 of holes, although this feature is optional. With the detected hole pattern, for example, base three arithmetic may be used to calculate the number that corresponds to this hole pattern. The base three arithmetic then assigns a unique number to the tag. It is appreciated that the same hole pattern or a different hole pattern may be assessed using a different base of arithmetic. It is therefore apparent that, by changing the location of the holes in each row and the number of holes in each row by base three arithmetic, unique numbers can be assigned to each tag which, for example, may be approximately 20,000 unique numbers for each tag. Furthermore, the hole size is, as already indicated, sufficiently large to facilitate detection even if there is some debris in any one of the holes and thereby significantly enhance the accuracy of the reading system in identifying the carcass on each trolley.

Further details of two exemplary meat processing lines are shown in Figures 14 and 15. The representations are provided to demonstrate the flexibility of the tag identification system and how it is readily used on different meat processing lines. In Figure 14, a beef processing line is generally designated 108. The live beef animal enters the knock-box 110 where the animal is rendered unconscious. The animal is picked up by a hind leg shackle and is conveyed along trolley track 112. The animal is hung on the leg shackle and at point 114 the ID tag on the leg shackle is read to identify the animal with

a unique code. This unique code can be cross-referenced to the live animal number. The animal is then transferred to trolley track 116 at transfer point 118. At transfer point 118, the different tag for the trolley that picks up the whole animal is read to assign a new code, such as numeric, to the transported animal where all of the proceeding information is transferred to the new numeric code. On trolley line 116, the animal is eviscerated. The innards are usually conveyed on moving table which accompanies the movement of the animal so that an inspection can take place of the innards to determine the overall health of the animal. Normally the veterinary inspection is at point 120. While travelling along line 116, the carcass is split in half and the carcass halves transferred at point 122 to trolley loop 124. As the halves are transferred to the trolleys on line 124, the code of each new trolley is read and all of the previous information associated with that carcass half as well as the remaining carcass half transferred to another trolley which again carries a unique code as well. The carcass halves are conveyed along line 124 to a hot scale 126 which measures the weight of each carcass half and that information as well is associated with the carcass by virtue of reading the tag and entering the weight of the carcass in conjunction with the unique code of that tag. The carcass halves are then transferred to an accumulating track 128 which is housed within a cooler 130 where the halves may be stored for 24 to 48 hours. The halves emerge from the cooler on a continuation of track 124 and are graded. At the grading station 132, various characteristics of the carcass half may be assessed either manually, visually or by computer operated equipment. Marbling of the meat may be assessed visually or may be assessed by computer operated video analysis system, such as described in PCT application SN _____. In addition, the tenderness of the meat may be assessed by the computer operated meat probe of the type described in PCT Applications CA97/00810 filed October 29,1997 and CA97/01019 filed December 31, 1997. All of this information is entered in the system and associated with the unique code for

each carcass half. The carcass halves are then transferred to a fabricating trolley system 134 which consists of tracks 136 and 138. At the fabrication transfer point 140, the unique codes for each trolley which picks up the carcass halves or quarters are read and the previous information involving that carcass is then transferred to the new code. At the fabrication station 134, the meat sections are broken down further and may be placed in trays which may carry tags which can be read. As a result, the broken-down sections of meat may be associated with the original carcass by virtue of reading the unique code on each fabrication tray. Hence, with this identification tag system, the broken-down sections of meat at fabrication station 134 can be traced back to the animal at knock-box 110 and all of the information associated with that meat can be brought forward in respect of its health and meat quality. This is achieved by reading the respective trolley ID tags onto which a carcass section is transferred at transfer points 118, 122 and 140.

A similar system of Figure 15 may be provided in respect of a pig processing line 142. The live pig enters the stun-box 144 where the animal is stunned and picked up by leg shackle in trolley line 146. The unique code on the trolley in line 146 is read at station 148 so that the information of the live animal is transferred to the unique code on the trolley carrying that animal. At transfer station 150, the code for the new trolley picking up the animal carcass is read and all previous information transferred to that new code. The trolley at this stage is usually the gamble hook which may be of the type shown in Figure 1 where the hind legs are hung on hook sections 26 of the gamble hook 24. The animal is gutted on trolley line 152 and the innards inspected at vet inspection stations 154. The health information is also then fed into the database and associated with the unique code identifying that carcass. In line 152, at station 156 the pig carcass is weighed and graded. The weight and grade information is also fed into the database and associated with the unique code of the trolley in 152. As with the beef grading, various assessment techniques may be used

which can be visual or automated by way of video analysis of the fat content and probing of the meat sections for tenderness. The carcass is transferred along trolley line 152 to the cooler area 158 which has the accumulator tracks 160. The animal is stored in the cooler up to 24 hours and transferred into region 162 where the carcass is broken down into individual sections. The fabrication area 162 may contain trays onto which the sections of meat are placed and which may also include tags which can also be read. As a result, all of the information relating to the animal can be transferred to the unique codes on the trays which carry the broken down sections of that animal. The trolleys are then returned in the usual manner to be sanitized and to pick up additional carcasses as indicated by the dotted line 164. As with the beef line, all information relating to the broken down sections of pork can be related by way of the identification tag system where at each transfer point the new code of the trolley which picks up the animal is read and all information transferred to that new code.

As shown in the remaining figures, the identification tag, in accordance with this invention, may be attached to a variety of meat trolleys. A significant feature of this invention is the ability of the system to accommodate varying trolley designs and trolleys of differing materials whether they be metal, plastic or synthetic fibre. The tag always presents a free edge portion which can be readily attached to the trolley by welding, adhesive bonding, fasteners, clips and the like. Ideally the tag is attached offset of the trolley hook so that it may be readily imaged such as by the camera imaging system. With reference to Figure 16, a shackle trolley generally designated 166 includes a trolley rail 168, a trolley wheel 170 and a trolley drive chain 172 with dogs 174. The trolley wheel 170 has mounted thereon the trolley shank 176. Secured to the trolley shank is a shackle chain 178. The shackle chain is secured around an animal hoof for purposes of lifting the animal from the ground. The shank 176 for the shackle trolley readily accommodates a tag 180 of this invention. The tag may

be of steel. In this situation, because the shank is also of steel, the tag can be welded to the shank in the usual manner.

Figure 17 is a view of a carcass trolley with a beef hook 182 secured to the trolley shank 184. The trolley wheel 186 rides along the trolley rail 188 and is advanced by the drive chain 190 which has dogs 192. The shank portion 184 is much thinner than the shank 176 of the shackle trolley. In any event, a suitable tag of this invention 194 may be secured to the shank 184. Depending upon the material of the shank 184, the tag 194 may be of the same material and welded, adhered or fused to the shank.

Figure 18 shows a whole carcass trolley 196. The trolley wheel 198 carries a shank 200. The shank 200 has attached thereto a gamble hook 202, not unlike the hook system of Figure 1. The trolley wheel is advanced along the rail 204 by drive chain 206. A tag 208 of this invention may be conveniently fastened or welded to the shank 200. In Figure 19, the fabrication trolley 210 has two trolley wheels 212 which ride along rail 214 and are driven by drive chain 216. The shank 218 for the trolley 210 is very narrow and may be of plastic material. A chain 220 is attached to the shank 218 where the chain carries a small hook for transporting a small portion of the carcass. Because of the size and location of the shank 218, a tag 222, in accordance with this invention, may be secured to the shank 218 to extend longitudinally away from the shank 218. This permits reading of the tag without interfering with the swinging movements of the chain 220.

The discussion of the various trolley types of Figures 16 through 19 demonstrate the flexibility of the tag system. It can be readily attached to any type of meat carrying system and accommodate a variety of materials whether they be of metals, special alloys, plastics, reinforced plastics, glass fiber reinforced synthetic composite, or wood. The tag is also able to accommodate attachment to cramped spaces on the shank of the trolley, such as demonstrated with respect to Figure 19. Alternatively, as required as shown in Figure 17 the

tag is mounted on the shank 184 has its upper portion 224 behind the rail 188. Hence a portion 226 of the rail is cut away to expose the complete tag for reading purposes.

Although preferred embodiments of the invention have been described herein in detail, it is appreciated that variations may be made thereto without departing from the spirit of the invention.

CLAIMS

1. A meat trolley having an identification tag attached thereto without compromising meat trolley strength, said identification tag having a machine readable code peculiar to said particular meat trolley, said tag having a free edge portion and means for attaching said free edge portion to said trolley at a predetermined location to facilitate machine reading of said peculiar code, said tag having a plurality of holes formed therein which extend through said tag and are formed in said tag in a pattern unique to said peculiar code for said meat trolley.

2. A meat trolley of claim 1 wherein said tag is rectangular in shape, said rectangular tag having said free edge extending parallel to rows of holes in said unique pattern.

3. A meat trolley of claim 1 wherein said tag is rectangular steel plate, said rectangular plate having said free edge welded to an arm of said trolley.

4. A meat trolley of claim 1 wherein said plurality of holes are arranged in three vertical rows of holes where said pattern of holes is unique to each respective tag.

5. A meat trolley of claim 1 wherein said holes formed in said tag are sufficiently large to minimize blocking of each hole with debris, oil or water.

6. A meat trolley of claim 5 wherein said holes formed in said tag have a diameter in the range of about 1/8 inch to 3/16 inch.

7. A meat trolley of claim 1 wherein said tag has an individual hole above or below said pattern to provide a control in reading said unique pattern.

8. A meat trolley of claim 7 wherein said tag has distinct corners to permit imaging said tag and determining orientation of said tag.

9. A meat trolley of claim 7 wherein said tag has a distinct side edge opposite said free edge to permit imaging said tag and determining orientation of said tag.

10. A meat trolley of claim 1 wherein said tag is attached by said attachment means in said predetermined position and offset laterally of an arm of said trolley.

11. A meat trolley of claim 10 wherein said attachment means is a weld securing said tag offset of said arm.

12. A meat trolley of claim 4 wherein each vertical row of holes is capable of having at least five holes in each row.

13. A meat trolley of claim 12 wherein said pattern of holes represents an individual number in base three arithmetic.

14. A meat trolley of claim 1 wherein said holes are of uniform size.

15. A meat trolley of claim 10 wherein said tag is a rectangular steel plate having said free edge welded to said arm of said trolley with said rows of holes extending vertically.

16. A meat trolley of claim 1 wherein said tag is secured on top of said meat trolley whereby a code reader is positioned above said trolley to read said unique code of said particular tag.

17. A tag identification system for monitoring and tracking transport of meat in a packing plant, a trolley system for transporting sections of meat in whole animal form, carcass form, carcass halves or fabricated meat sections, said trolley system comprising individual trolleys for transporting individual sections of meat by hanging individual sections of meat from a trolley arm, a trolley identification tag having a machine readable code on a face portion thereof and a free edge which is secured to said trolley arm in a manner to position said machine readable code laterally offset of said trolley arm, said machine readable code being a plurality of holes formed in and passing through said tag, said holes being arranged in a pattern of three vertical rows where the pattern of holes in said three vertical rows are unique to said particular trolley, a camera system for reading said tags comprising a light source for illuminating said tags and a camera for reading said tags, a computer linked to said camera and being programmed to analyze an individual tag image recorded by said camera, said tag accommodating at least five holes in each vertical row where said pattern of holes defines said machine readable code in a selected base arithmetic, said programmed computer aligning said image of said tag and assigning each hole of said image of hole pattern a value to determine thereby said unique code for said tag, means for sensing presence of said trolley tag to activate said camera to image said tag hole pattern, said light source being of sufficient intensity to illuminate holes at least partially blocked with oil, water, ice, translucent debris and the like.

18. A tag identification system of claim 17 wherein said step of assigning a value to each hole of said image of hole pattern includes locating each hole by

its center and determining if such center point is in a particular row of said three rows of holes and the level of said hole in any one row.

19. A tag identification system of claim 18 wherein said holes are each formed with a minimum cross-section of 1/8 inch.

20. A tag identification system of claim 17 wherein said tag is rectangular, said alignment of said image locating a straight edge of said rectangular tag which is opposite said free edge.

21. A tag identification system of claim 17 wherein said camera is a video camera, said light source being positioned on one side of said trolley system and said camera being positioned on the other side of said trolley system whereby said camera detects light transmitted through said holes.

22. A tag identification system of claim 17 wherein said camera is a video camera, said light source being positioned on the same side of said trolley system as said camera, said light source illuminating the face of said tag to highlight said holes.

23. A tag identification system of claim 17 wherein said selected base arithmetic is base three arithmetic.

FIG.1

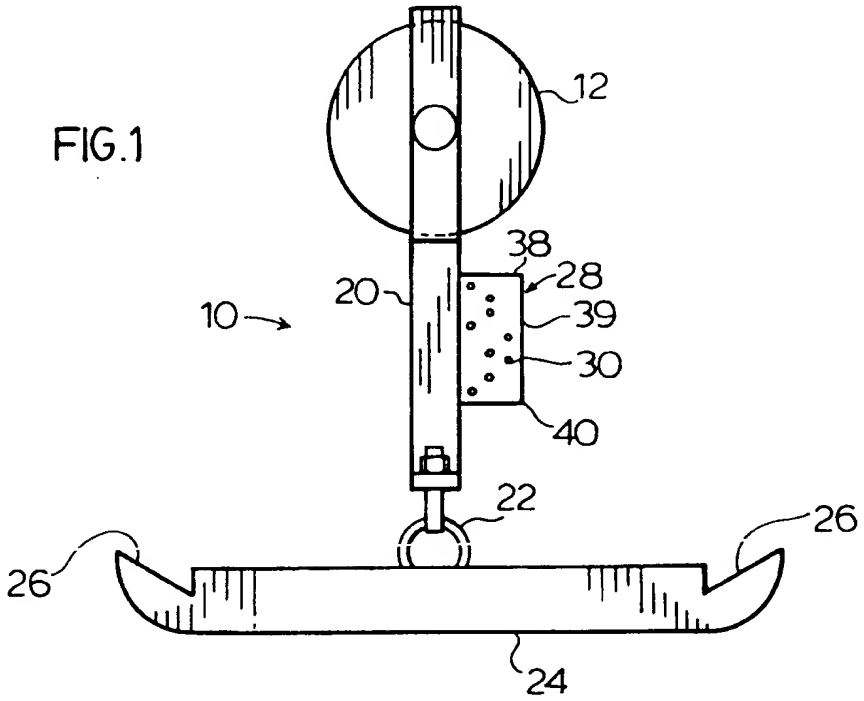


FIG.2

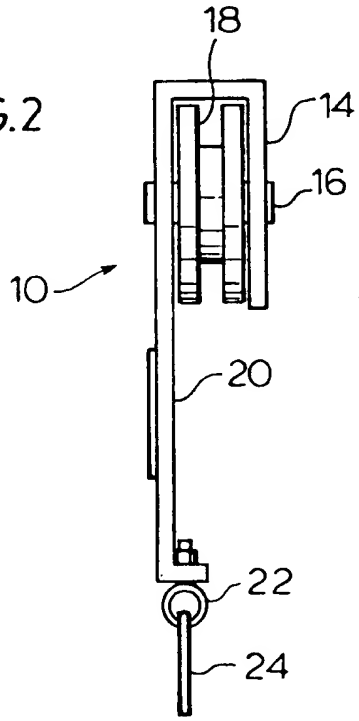


FIG.3

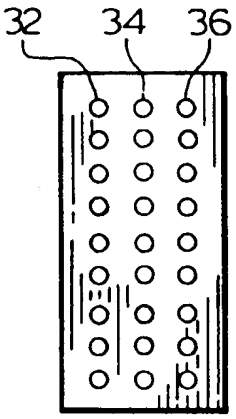


FIG.4

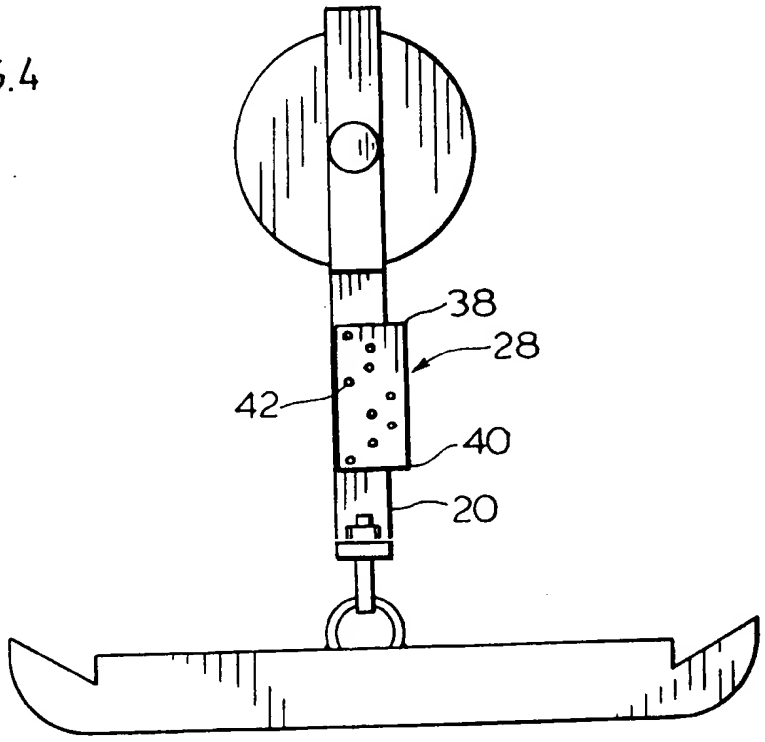


FIG.5

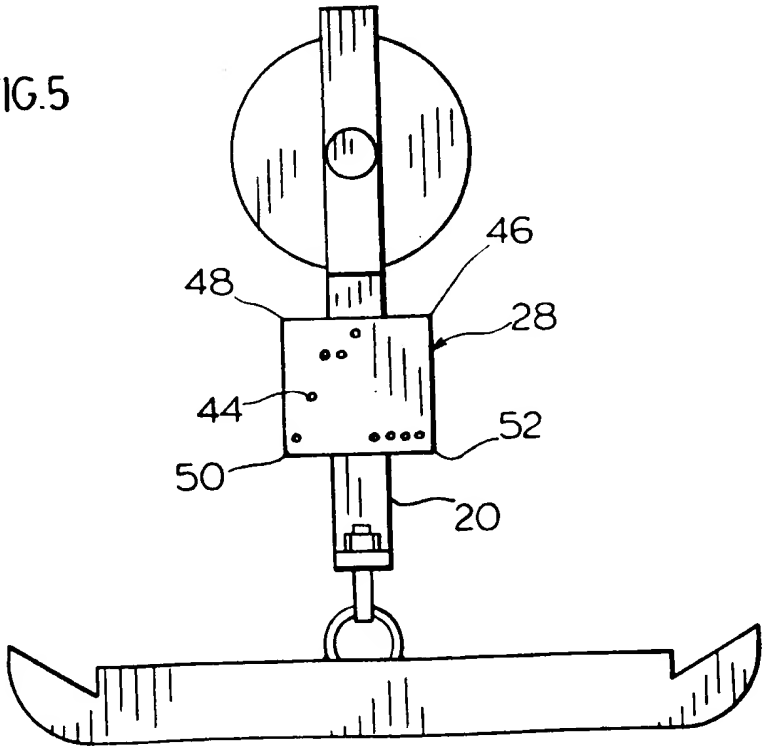


FIG.6

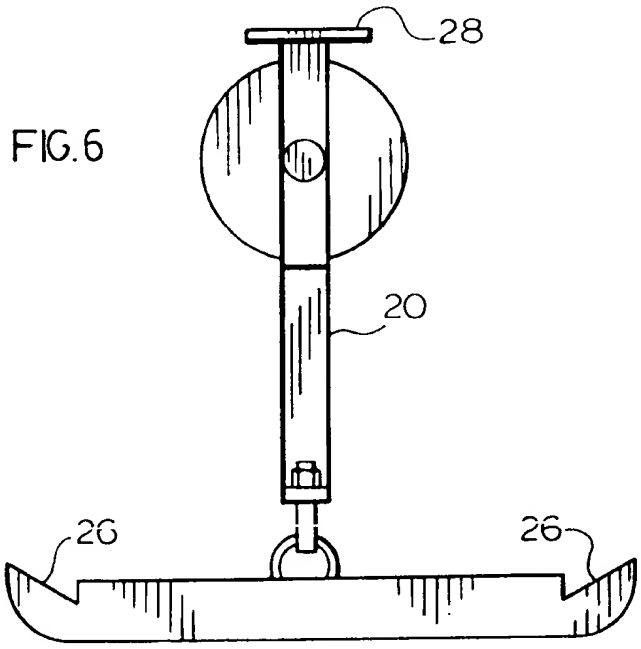


FIG.7

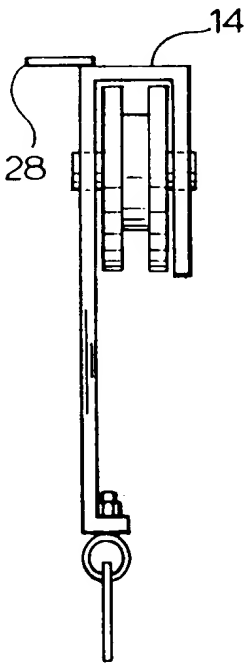
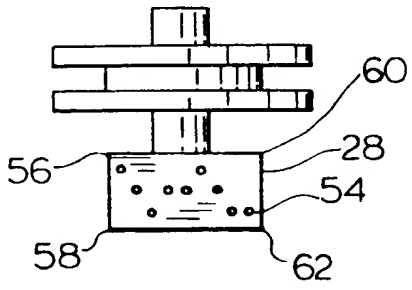


FIG.8



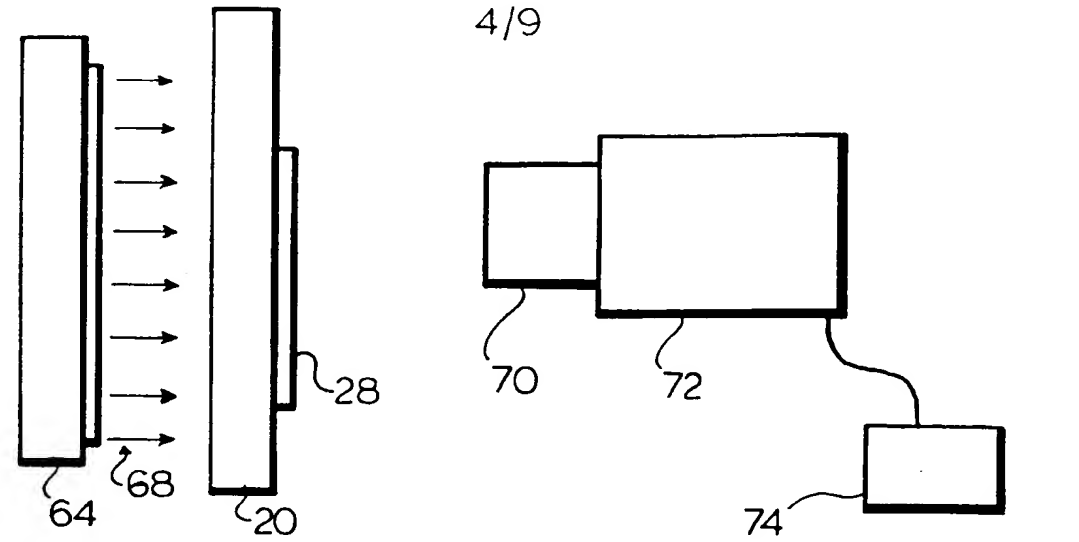


FIG.9

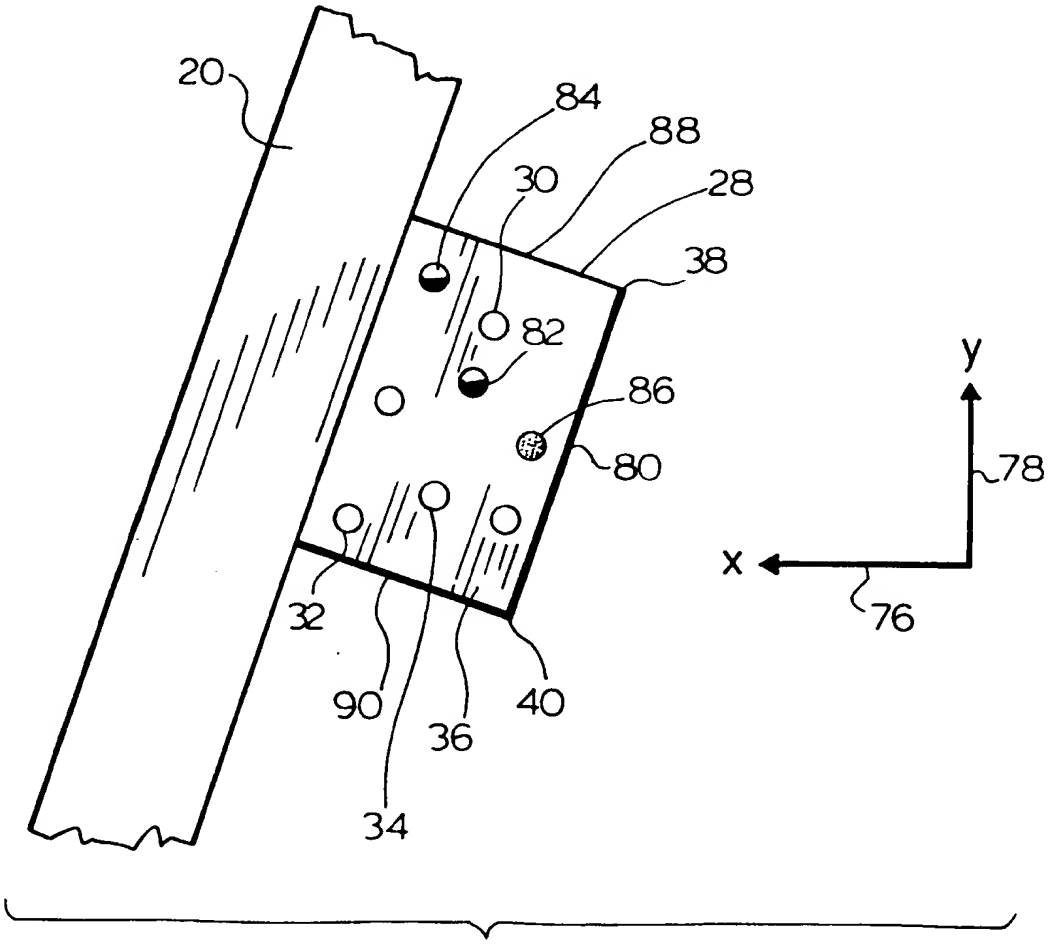


FIG.10

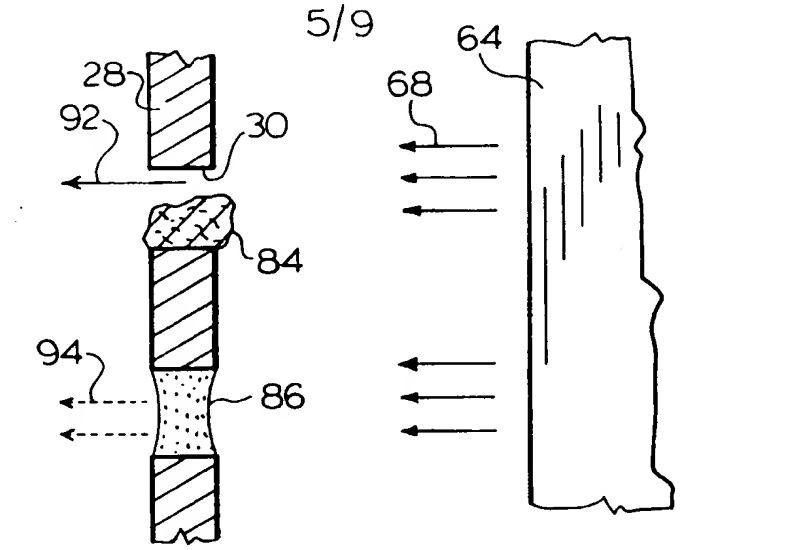


FIG.11

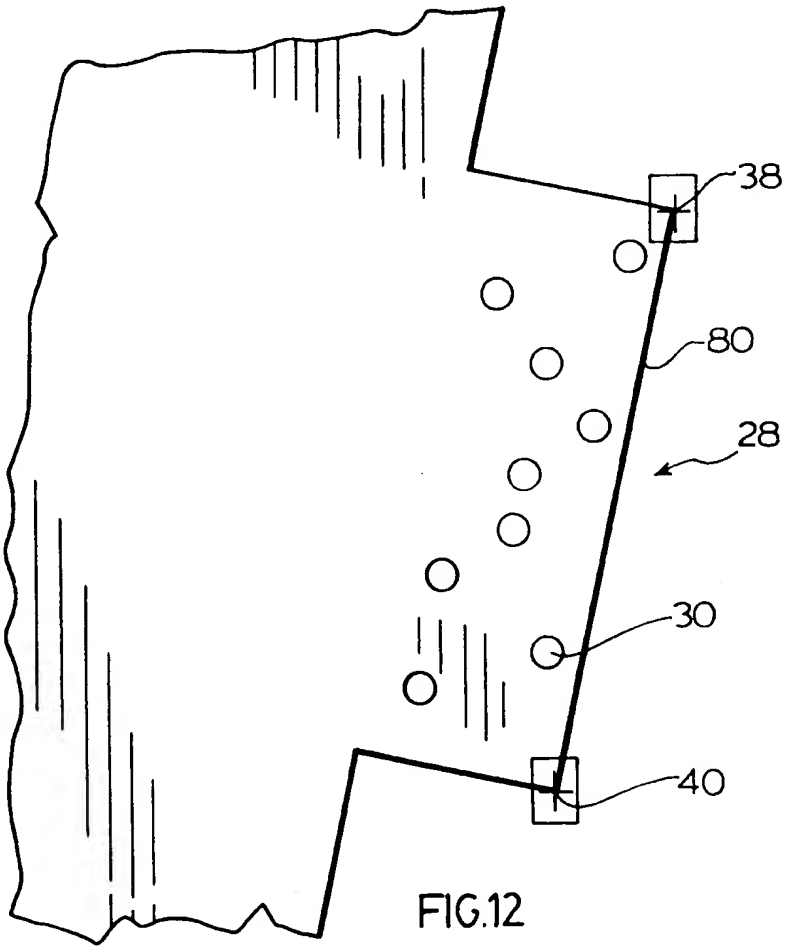


FIG.12

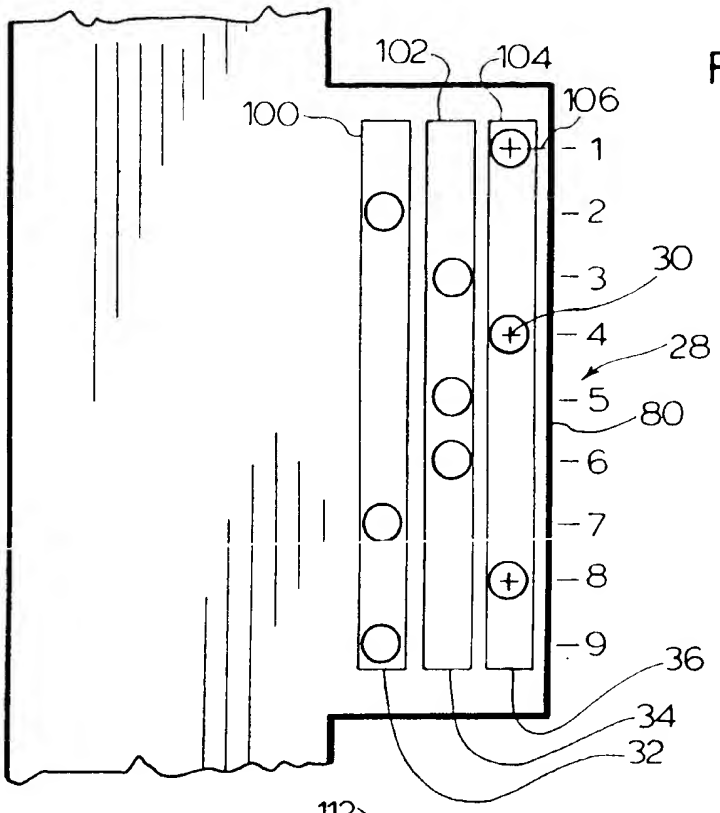

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FIG.13

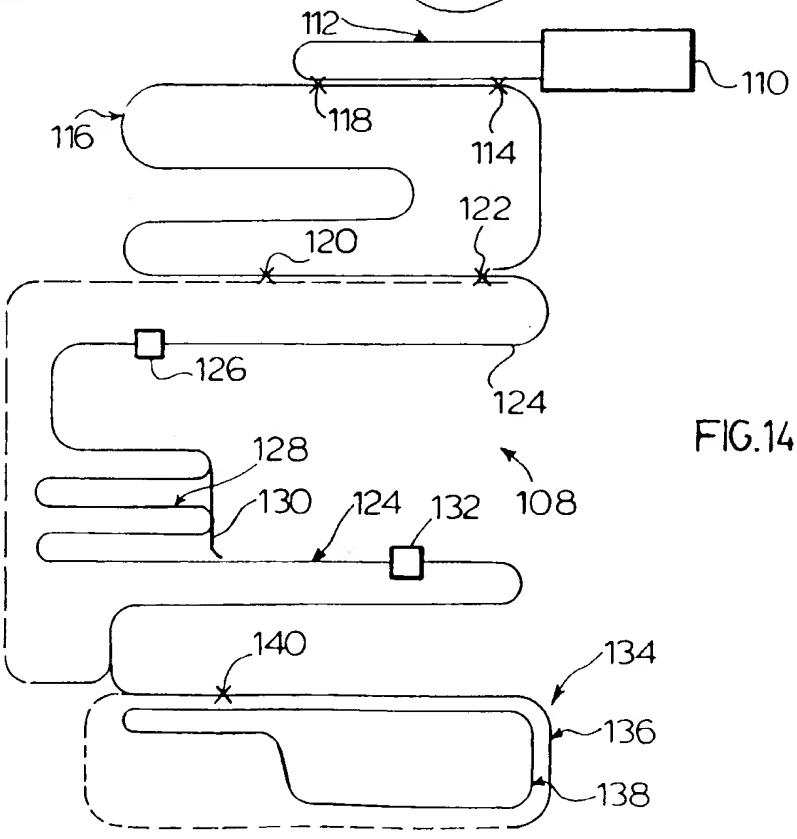
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FIG.14

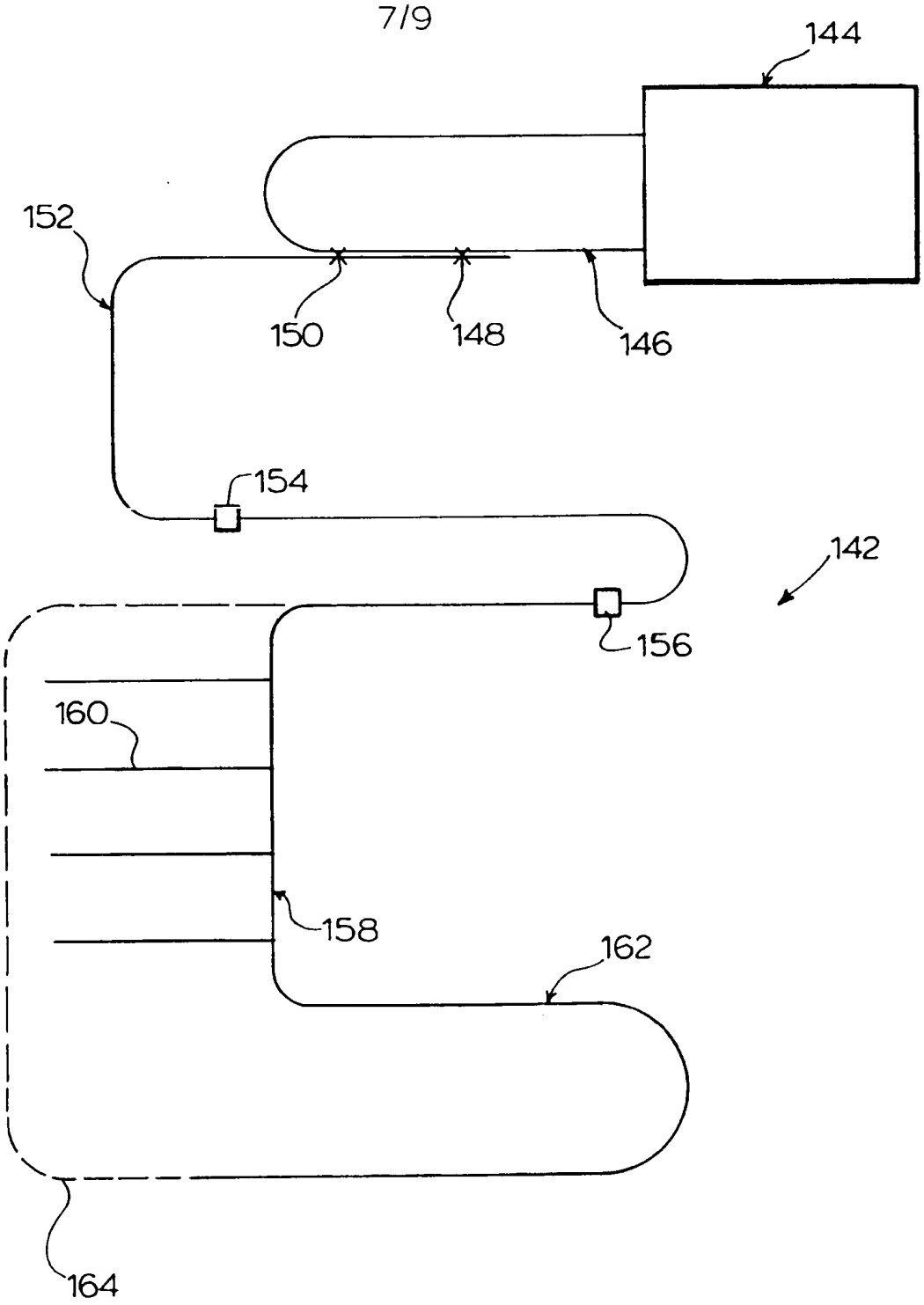

FIG.15

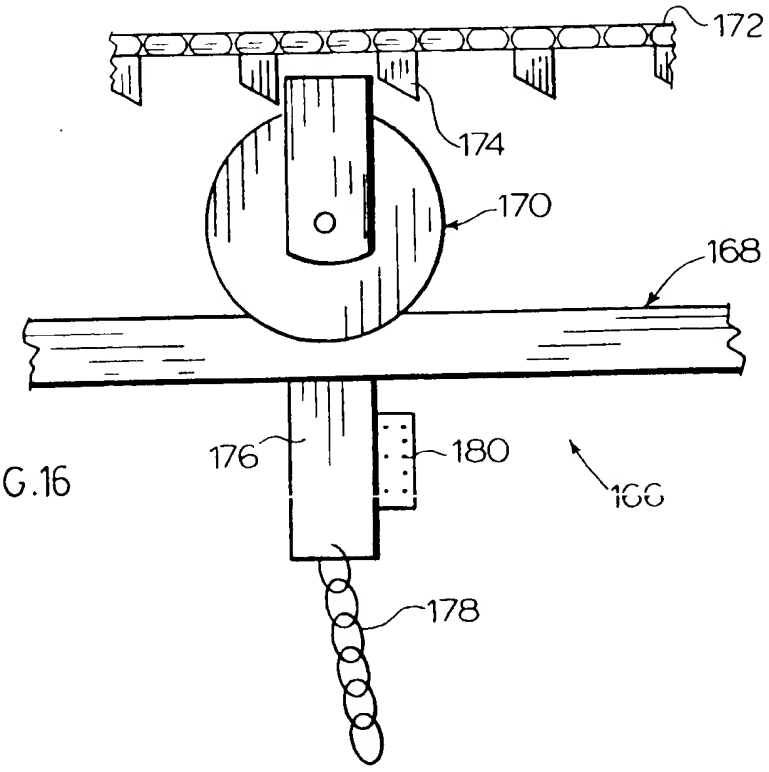
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FIG.16

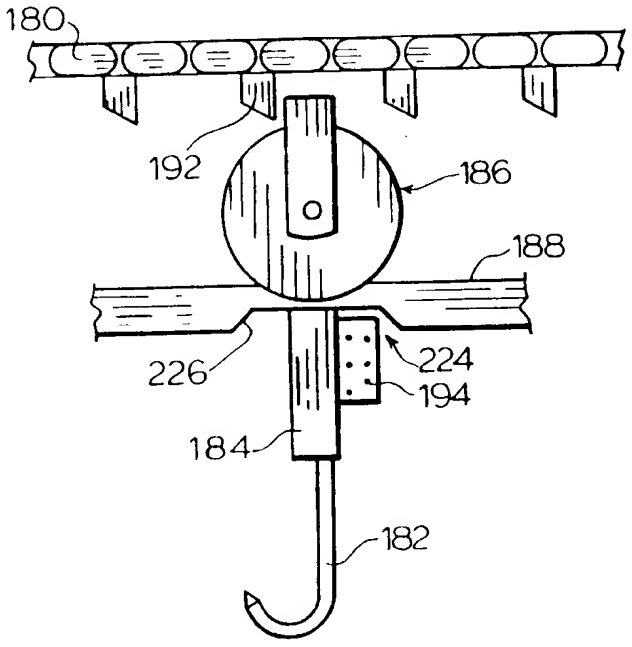
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FIG.17

FIG.18

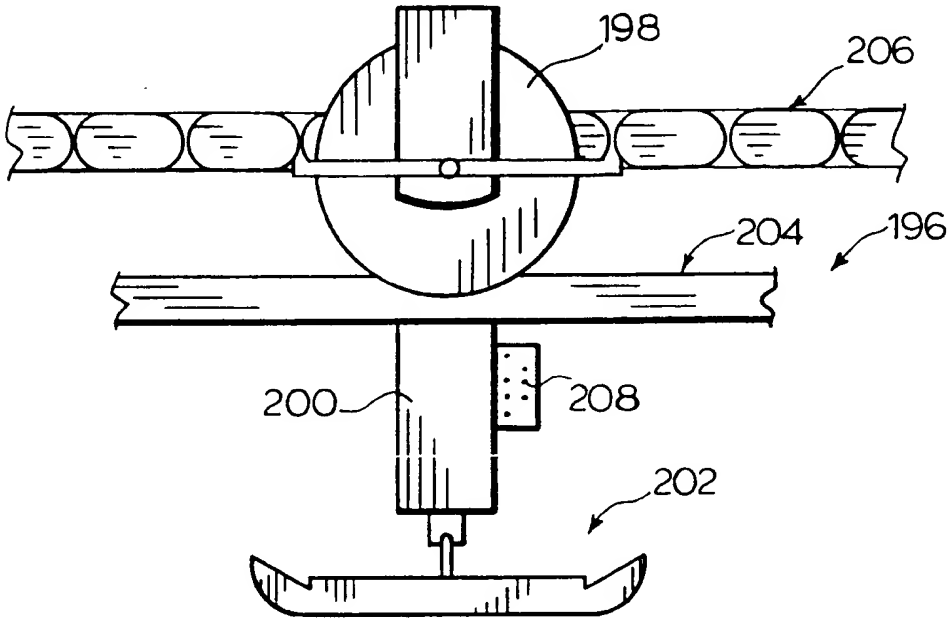
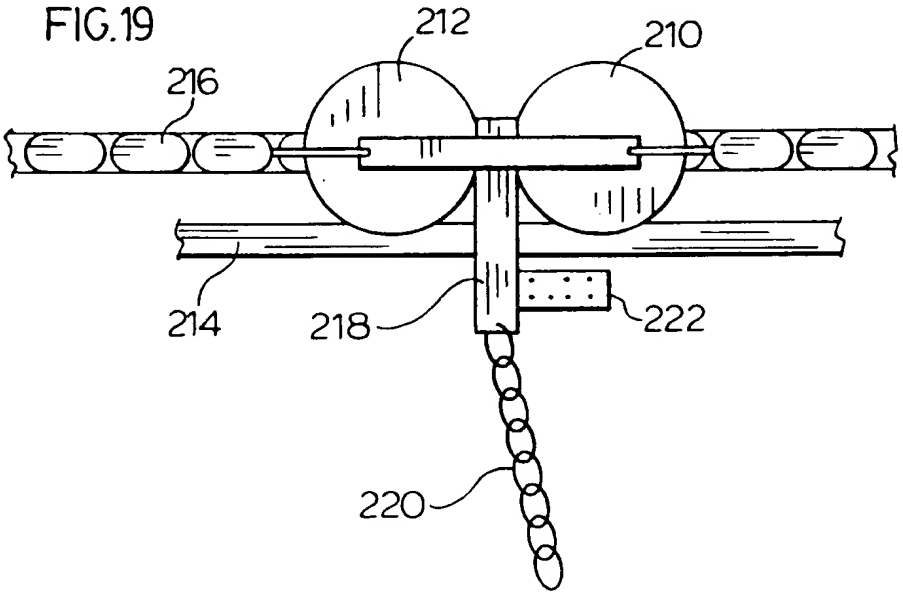


FIG.19



INTERNATIONAL SEARCH REPORT

Inter ·nal Application No
PCT/CA 98/00134

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A22B5/00 A22B7/00

According to International Patent Classification(IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A22B G06K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 41 32 830 A (BANSS MASCHINENFABRIK GMBH & CO KG) 8 April 1993 see column 3, line 32 - column 4, line 49 see column 7, line 50 - column 9, line 18; figure 3 -----	1-4,7-9, 11-15, 17,20-23

☐ Further documents are listed in the continuation of box C

[X] Patent family members are listed in annex

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 May 1998	09/06/1998

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	von Arx, V.

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Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Inte. ›nal Application No
PCT/CA 98/00134

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 4132830 A	08-04-1993	DE 9116701 U	16-06-1994